NH Department of Natural & Cultural Resources
Division of Forests & Lands
Forest Health Program

Annual Newsletter 2017

Forest Tent Caterpillar
White Pine Bast Scale
Browntail Moth

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IN THIS ISSUE:

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FIELD SURVEYS

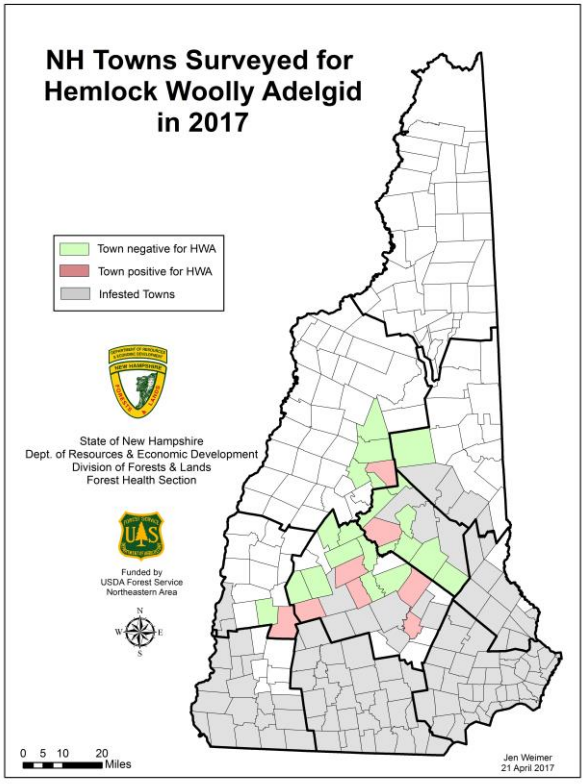
By: Jen Weimer

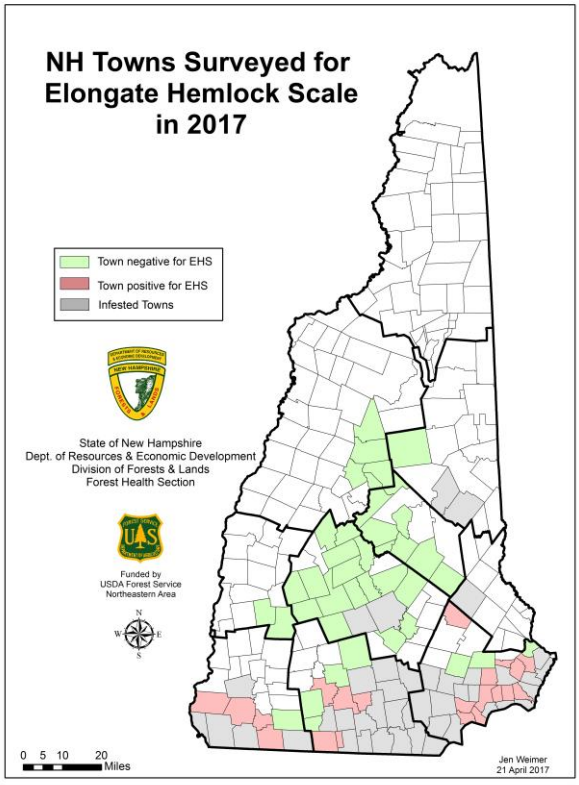
Hemlock Woolly Adelgid and Elongate Hemlock Scale

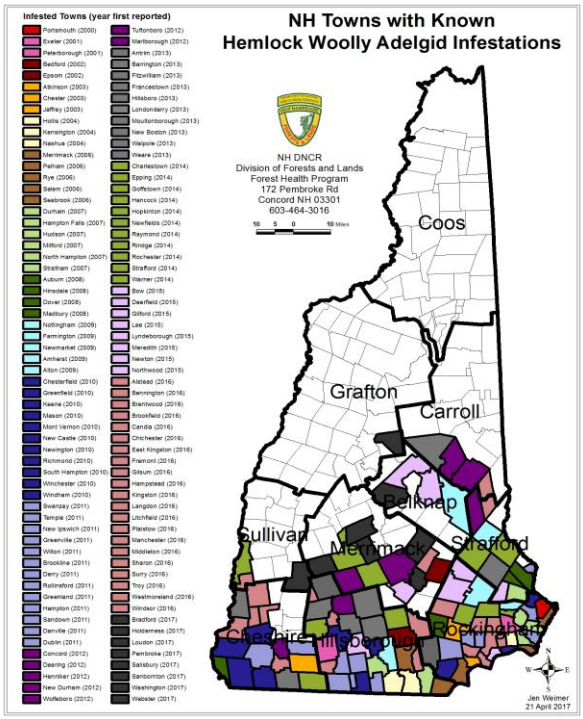
Hemlock Woolly Adelgid (HWA) surveys for 2017 were done in 29 towns that border the northernmost infested area. Towns surveyed included Loudon, Pembroke, Bradford, Lempster, Sutton, Salisbury, Danbury, Hill, Sanbornton, New Hampton, Center Harbor, Holderness, Sandwich, Thornton, Webster, Boscawen, Canterbury, Plymouth, Ashland, Campton, Washington, Newbury, Andover, Franklin, Laconia, Belmont, Tilton, Gilmanton, and Barnstead. Infestations were found in Loudon, Pembroke, Bradford, Salisbury, Sanbornton, Webster, Washington, and Holderness. Holderness is the first detection in Grafton County.

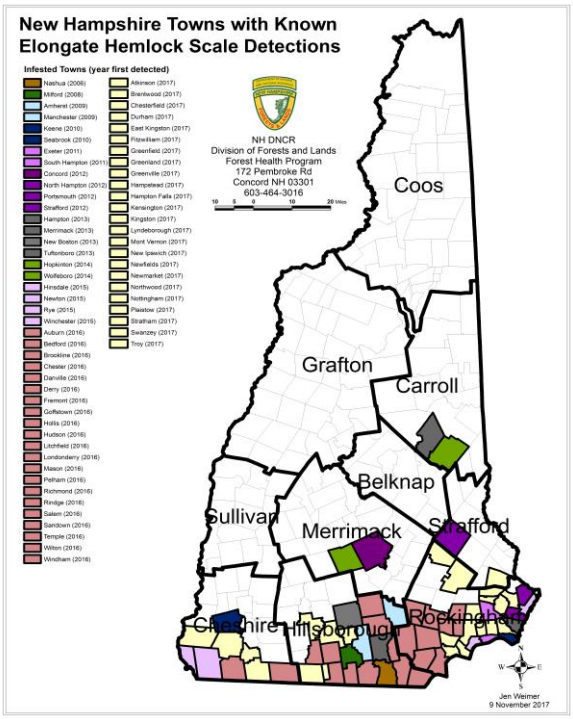
Elongate Hemlock Scale surveys for 2017 were done in conjunction with HWA surveys and in 36 southern towns abutting towns with known infestations. Towns surveyed included Chesterfield, Swanzey, Jaffrey, Peterborough, Greenfield, Francestown, Lyndeborough, Mont Vernon, Weare, Henniker, Warner, Webster, Canterbury, Loudon, Brentwood, Pembroke, Bow, Raymond, Epping, Newfields, Greenland, Stratham, Newington, Kensington, Hampton Falls, Atkinson, Plaistow, Hampstead, Kingston, East Kingston, Fitzwilliam, Troy, New Ipswich, Greenville, Sharon, and Northwood. New infestations were detected in chesterfield, Swanzey, Greenfield, Lyndeborough, Mont Vernon, Brentwood, Newfields, Greenland, Stratham, Kensington, Hampton Falls,

Atkinson, Plaistow, Hampstead, Kingston, East Kingston, Fitzwilliam, Troy, New Ipswich, Greenville, and Northwood.



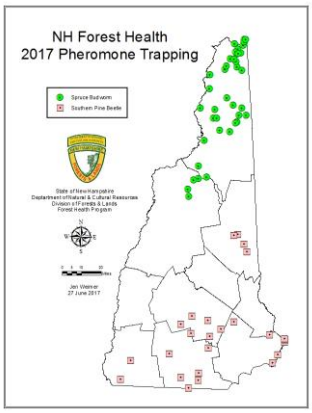


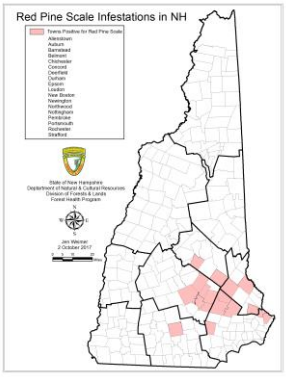




Spruce Budworm and Southern Pine Beetle

Spruce Budworm trap catches are up slightly from last year but not as high as 2015 and remain at endemic levels. This was our third year trapping for Southern Pine Beetle in response to the recent northern spread of the beetle and we did not detect any in our traps again this year.





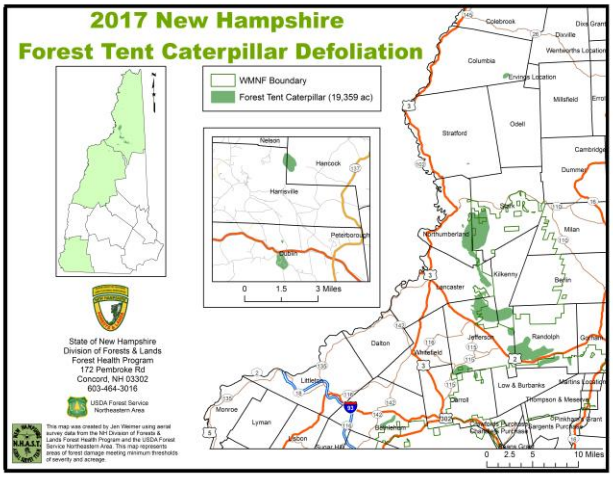
Red Pine Scale

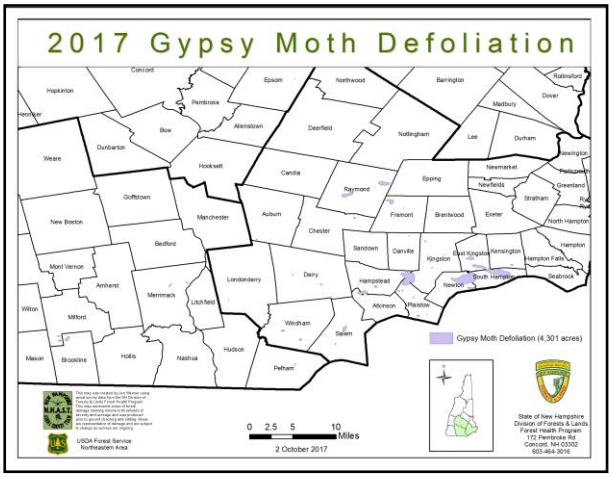
Red Pine Scale continues to spread throughout the southern half of the state and new infestations were detected this year in Auburn, Northwood, and Nottingham.

NH Aerial Survey Highlights for 2017

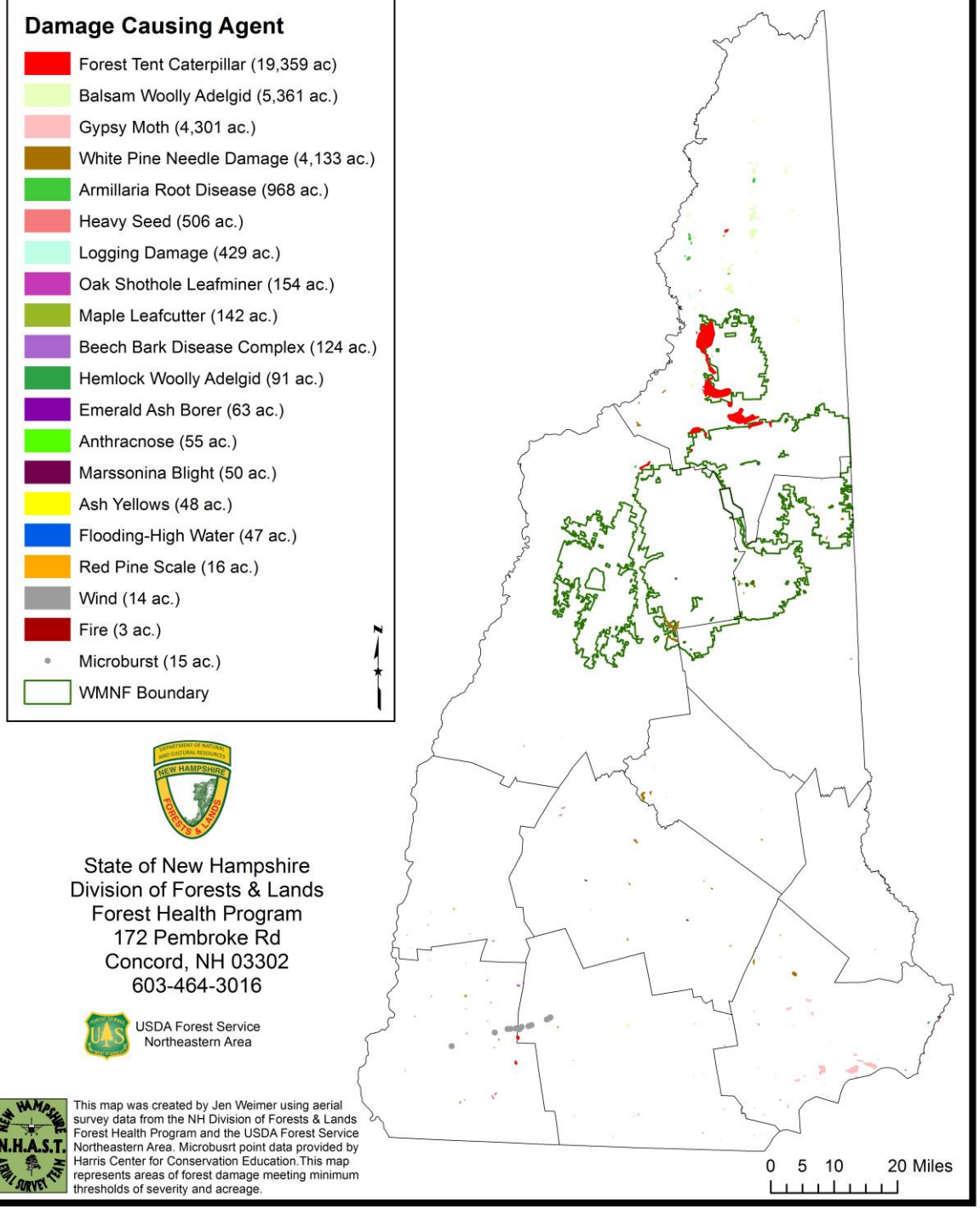
By: Jen Weimer

New Hampshire's annual aerial survey is a cooperative effort between the NH Division of Forests and Lands (NHDFL) and the USDA Forest Service Northeastern Area State and Private Forestry (USFS). This year we mapped 25,520 acres of damage on state and private lands. The USFS mapped additional acreage on the White Mountain National Forest. Defoliation from **forest tent caterpillar** was the primary damage causing agent this year with nearly 20,000 acres mapped in Coos County and the White Mountain National Forest. **Gypsy moth** populations increased in the southeastern part of the state and defoliated 4,301 acres. Additional defoliation thought to be gypsy moth in the southwestern part of the state turned out to be from **maple leafcutter** (142 ac.). Other damage causing agents mapped by us include **balsam woolly adelgid** (5,361 ac.), **needlecast diseases on white pine** (2,982 ac.), **armillaria root rot** on white birch (968 acres), **heavy seed crop on red maple** (506 acres), **logging damage** (429 ac.), **oak shothole leafminer** (154 acres), **beech bark disease** (124 ac.), **hemlock woolly adelgid** (91 ac.), **emerald ash borer** (63 ac.), **ash yellows** (48 ac.), **oak anthracnose** (55 ac.), **marssonina blight on aspen** (50 ac.), **flooding** (47 ac.), **red pine scale** (16 ac.), **wind** (14 ac.), and **fire** (3 ac.).





2017 New Hampshire Forest Damage



State of New Hampshire
Division of Forests & Lands
Forest Health Program
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USDA Forest Service
Northeastern Area

This map was created by Jen Weimer using aerial survey data from the NH Division of Forests & Lands Forest Health Program and the USDA Forest Service Northeastern Area. Microbusrt point data provided by Harris Center for Conservation Education.This map represents areas of forest damage meeting minimum thresholds of severity and acreage.

BUTTERNUT UPDATE

By: Kyle Lombard

2016 was the 20th anniversary of the butternut grafting project cooperatively funded and participated in by the US Forest Service, NH State Forest Nursery, and the Forest Health Program. Last year while reviewing the results of this project we realized many of the trees in the program were potential hybrid crosses between butternut and Japanese walnut, also called "heartnut" Juglans ailantifolia. This past spring we collected twig samples from the five healthy butternuts and ten less healthy trees remaining in the program and sent them to Purdue University where Dr. Keith Woeste and his lab did DNA extraction to definitively determine whether the trees were native or hybrid. The results were clear and the five healthy butternuts were all hybrids. The ten unhealthy trees were all native juglans cinerea. Interestingly, Dr. Woeste pointed out that all five hybrids had seed parents that were butternut and pollen parents that were Japanese walnut. It's unusual in that the seed parent is usually Japanese walnut and the pollen is provided by butternut. Likely, what this indicates is that these trees hybridized naturally in NH on their own from a butternut and a planted Buartnut. Buartnut is the first generation cross of butternut and heartnut usually done in a commercial nursery. They were popularly planted throughout the late 1800's and early 1900's. I'm guessing some of these are still around and pollinating butternuts in NH creating a complex ancestry we are now calling "hybrids". Another interesting finding Dr. Woeste wanted to bring to our attention was that the ten native butternuts were grouped into three genetically district clusters or lineages. Yet geographically they were completely scattered across NH. Generally you expect genetic clusters to be together in one region and distinguishable from the genetics of another lineage of the same species in a different region. In further conversations with Dr. Woeste he mentioned that in Canada they believe the butternut in New Brunswick may be from a lineage that survived the ice age in a northern refugium. And possibly one or more of our three lineages could be from this same heritage. It's also possible one of these lineages could be from the southern states or western states brought home during the civil war or exploratory travel even earlier. DNA analysis and genetics in forest ecosystems is an emerging science and we have so much more to discover. It'll be fun in the coming years trying to figure ways to learn more about the past and future of such a unique tree species.

Native butternut on the left heavily infected around the root flare and lower bole. On the right, hybrid butternut in Newbury, NH showing no sign of infection

EAB UPDATE

By: Bill Davidson

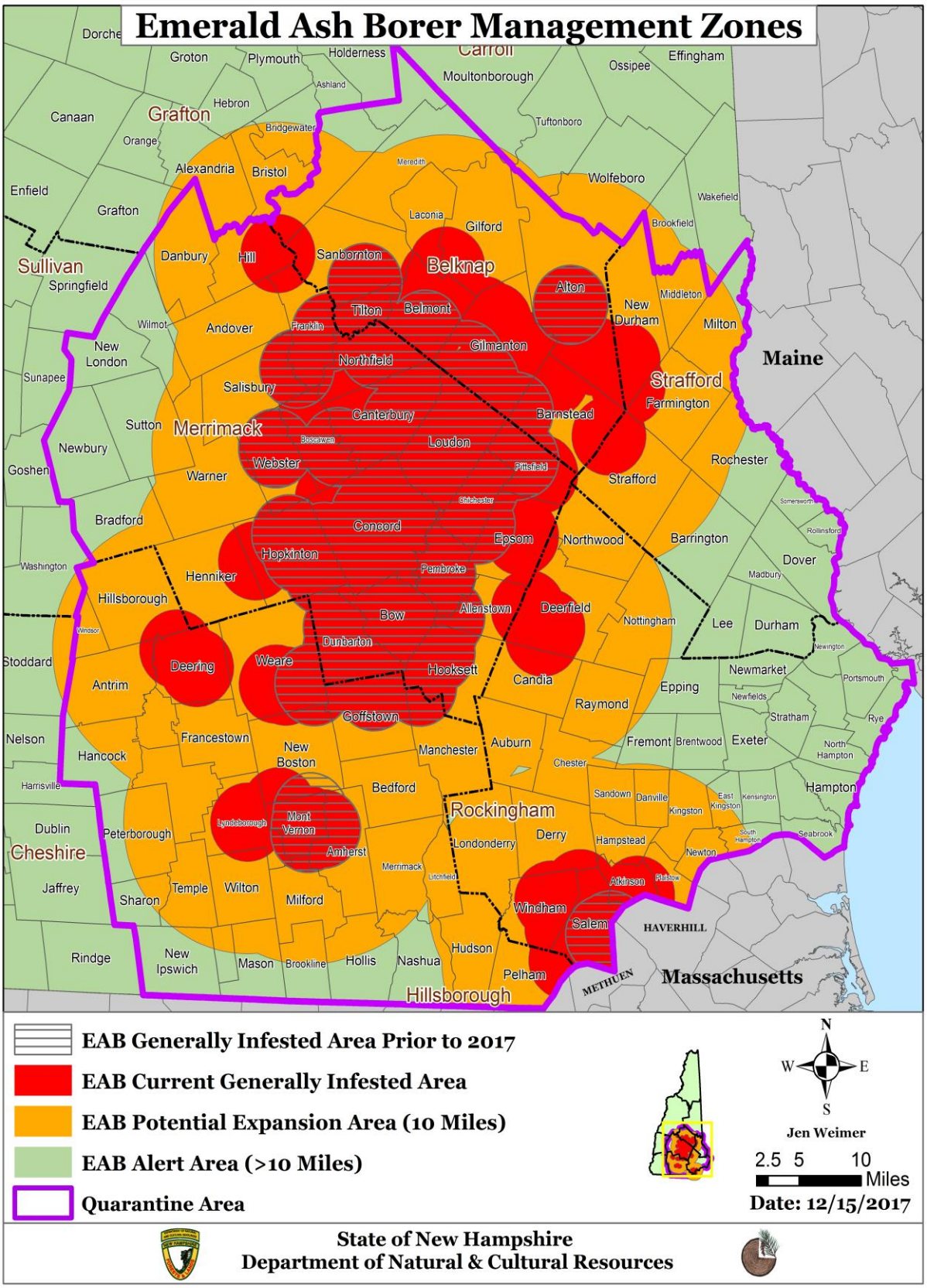
New Detections

2017 saw a large expansion in the range of emerald ash borer in New Hampshire. Detections were made in 15 new towns, the most of any year to date (see attached map and graph), and included New Durham and Strafford which represent the first towns in Strafford County. The finds in Strafford County resulted in its addition to the Federal Emerald Ash Borer Quarantine which prohibits movement of ash material and hardwood firewood from within the quarantined counties to un-infested counties; the fifth of New Hampshire's counties to be included. Detections made this year have increased the area considered to be generally infested (< 3 mi. from a known infested tree) by roughly 50%. As the range of emerald ash borer increases so does the number of infested ash that can be made into firewood and inadvertently spread the pest. The best ways to minimize the risk of unintentional movement are to adhere to the federal quarantine and to follow the best management practices (BMPs) for handling ash. The first step in adhering to the BMPs is to know where you are in relation to infested areas, and the best tool for finding this information is the "Emerald Ash Borer Management Zones" map which is regularly updated and can be found on the www.NHbugs.org website. Any ash located within the "Generally Infested Area" or within the "Potential Expansion Area" could potentially contain emerald ash borer larvae and should be treated as though they are infested. Here are some steps that can be taken to reduce the risk of spreading emerald ash borer and other pests via infested firewood: not moving wood more than a few miles from its origin, seasoning wood for over 12 months before moving, using kiln dried firewood, transporting logs during EAB's dormant period from October 1st – May 1st, chipping wood before transport, if/when traveling with wood make sure to burn it all and not leave any behind, and notifying recipients of potentially infested wood and the risks associated with that material. While not all steps will be followed in all circumstances, taking more precautions will greatly reduce the risk of spread. Currently only about 30% of area within the quarantine, and 10% of the state, is impacted by emerald ash borer. Taking steps to limit human facilitated movement, which represents the greatest vector for this pest, will slow the spread of emerald ash borer and meaningfully increase the longevity of ash in currently un-impacted areas.

The range of emerald ash borer in New Hampshire has vastly increased in the past few years. 2017 saw a roughly 50% increase in the area estimated to impacted by the emerald ash borer. In this time initial detections were made in 15 towns and 1 county.

Detection Method	Towns
Visual Survey	27
Prism/Funnel Traps	10
Public Reporting	2
Trap Trees	1
Cerceris fumipennis	1

A breakdown of the various methods used to detect new infestations of emerald ash borer. Visual survey is extremely useful for tracking localized spread from established outbreaks while traps are most effective at picking up infestations further from known outbreaks where visual symptoms of damage are minimal or lacking.


Emerald Ash Borer Management Zones
Grafton
Sullivan
Belknap
Merrimack
Strafford
Cheshire
Hillsborough
Rockingham
Maine
Massachusetts
EAB Generally Infested Area Prior to 2017
EAB Current Generally Infested Area
EAB Potential Expansion Area (10 Miles)
EAB Alert Area (>10 Miles)
Quarantine Area
N
W
E
S
Jen Weimer
2.5 5 10
Miles
Date: 12/15/2017
State of New Hampshire
Department of Natural & Cultural Resources

Management Recommendations
The expanding infestation has meant that many more people are being faced with difficult decisions about how to manage their forests and landscape trees. Knowing where you are in relation to infestations is crucial to making informed decisions, and again we refer to the "EAB Management Zones Map". Any ash within the "Generally Infested Area" can be assumed to be infested or will become infested in the near future. Keep in mind that a tree may be infested for several years before it begins to show signs of decline, so if some ash trees in a given area are exhibiting signs of attack it is safe to assume other ash in the area are also infested. Ash decline in infested areas tends to start out intermittently with many trees still appearing healthy years after nearby trees have been killed off. It is therefore necessary to evaluate trees for treatment on a case by case basis, with the rule of thumb being that if a tree is exhibiting less than 50% dieback (has more than half of its crown remaining) then it can likely be saved using insecticides, and the healthier a tree is at time of treatment the more likely the treatment is to be successful. Landscape trees in the "Potential Infestation Area" are far enough from any known infestations that treatments can be held off until nearby trees begin to show signs of decline. You can visit www.nhbugs.org to find lists of pesticide applicators and arborists who will be able to give treatment advice, perform pesticide applications, and prune/remove dying trees.

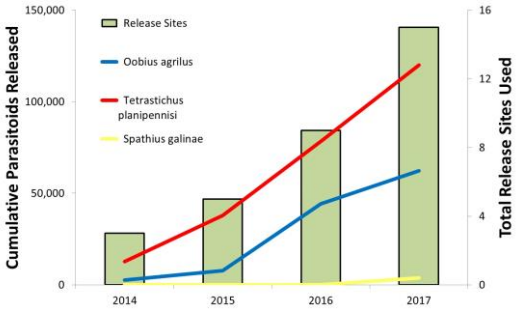
Recommendations for ash in forests are also based on the proximity to known infestations. Ash in the "Generally Infested Area" are likely already infested and if still alive will likely be dead in 3-5 years even if they appear healthy now. For the "Potential Expansion Area" it is more difficult to predict a timeline for decline but it can be assumed that trees in this area will become infested in the next 1-5 years and all ash will likely be killed off within 10 years. Infested trees are still able to be harvested as the beetle itself does not degrade the value of the wood, but it is important to follow quarantine and BMPs when dealing with infested material to prevent further spread. We also recommend leaving ash with a DBH less than 6" ash they have minimal economic value but provide valuable breeding habitat for natural enemies of EAB released through the biological control program.

Biological Control
We continue to participate in the emerald ash borer biological control program and the Division of Forests and Lands released parasitoids over 60,000 parasitic wasps (parasitoids) across five sites this year, with three new sites in Alton, Hooksett, and Mont Vernon. Six additional sites received releases as part of projects being carried out by researchers at UNH and USDA-APHIS which are studying foraging and behavioral patterns of the parasitoids. Since the initiation of the program in NH in 2014, 16 total sites have received releases. In previous years two species of parasitoids were deployed: *Oobius agrili* which parasitizes EAB eggs, and *Tetrastichus planipennisi* which parasitizes EAB larvae. This year a third species¸ *Spathius galinae,* was released for the first time in New Hampshire. This species is larval parasitoid which is a considerably larger insect than *T. planipennisi* and is capable of attacking EAB larvae in bigger trees. We have seen encouraging signs of parasitoid establishment and have recovered *T. planipennisi* from all sites where the requisite two years of releases have been

completed, and in one case recovered wasps over three miles from the nearest release site.

Biological control is also being utilized as part of a low-input integrated pest management strategy aimed at slowing the spread of emerald ash borer from an early stage infestation on the periphery of the larger infestation. Through this management program parasitoid releases are conducted in conjunction with applying insecticide to the largest and most ecologically significant ash in the treatment area. The insecticide applications will provide complete protection to the treated trees by killing any beetle larvae that feed on their wood and prevent those trees from being colonized by EAB. Since treated trees will be completely devoid of EAB larvae there is minimal risk of accidentally exposing the wasps the insecticide. The treatments will also provide residual benefit to nearby trees by killing any adult beetles that feed on their leaves which will reduce the overall population of EAB in the forest. This residual benefit is increased by selectively girdling ash adjacent to the treated trees which will attract adult EAB to the area and increase the likelihood of adult EAB feeding on leaves of the treated trees. Beetle populations will further reduced removing and destroying trees as they become visibly heavily infested. When an infestation is discovered early, an IPM management program can significantly delay mortality of ash in the forest along with reducing the rate of spread. Delayed ash mortality will also buy more time for parasitoids to become established and build their populations which will further slow ash decline in the immediate and surrounding areas.

Integrated pest management being carried out at Alton Bay State Forest. An emamectin benzoate based insecticide is injected directly into a large ash tree (foreground) while an adjacent ash has been girdled to attract adult emerald ash borers to the treated tree (background).



Biological control continues to be implemented as the most promising long term management solution for preserving as in New Hampshire's forests. New sites are utilized each year to keep up with spreading EAB populations. This year a new larval parasitoid, *Spathius galinae*, was released in small numbers at a few locations with greater numbers expected to be deployed in coming years.

FEATURE ARTICLE

By: Kyle Lombard

Historic brown-tail moth eradication in New Hampshire

This past year the office of the State Entomologist was cleaning a storage area and found an old file on the brown-tail moth eradication project of 1934. The fact that more than 1500 men in New Hampshire worked on an insect project in less than a three month period, and destroyed over 9 million overwintering nests, makes it worth telling the story.

On the right, brown-tail moth nests overwintering in apple trees. On the left, men climb and remove nests.

The United States was in the midst of the great depression that started in 1929 and Franklin D. Roosevelt had just taken over as President in 1933. President Roosevelt started a policy known as the "New Deal" to put millions of unemployed Americans to work on public works projects. The first agency to start working on this concept was the Civil Works Administration and they gave $870,850.00 to the USDA Bureau of Plant Quarantine to administer a brown-tail moth extermination project in Maine, NH, VT, and MA. It was a pretty simple project. Hire 5,000 unemployed men to cut out all the overwintering nests in the infested trees and burn them. In NH, the office of the State Entomologist and the Bureau of Plant Quarantine hired 1,635 men who earned a total of $180,000 in wages for 313,978 hours worked between December 21, 1933 and February 16, 1934. These 1,635 workers examined a total of 12,032,865 trees and destroyed 9,766,970 nests in just two months. The area of operation extended throughout all Counties south of Grafton and Carroll. 60% of the

Bags of brown-tail nests loaded on a truck in 1934

nests destroyed were cut from apple trees, the rest from oak and other hardwoods. The project was abruptly dissolved with only 48% of the funding expended as the Civil Works Administration was eliminated and a more permanent Works Progress Administration took charge. Programs like the Civilian Conservation Corps and many others were created and a long term strategy was implemented.

The Forest Health Program has continuously surveyed for brown-tail moth since the late 1980's and no outbreaks have been found in that time period. However, there has been an outbreak in the Portland, Maine area for many years but it doesn't seem to spread from that coastal region. If you wonder why people would consider ever embarking on such a project to eradicate an insect you should know brown-tail moth is non-native, a major defoliator of fruit trees and oak forests, and was introduced into Massachusetts in the late 1800's. And more importantly it is poisonous to humans. Many of the short barbed hairs on the larvae are hollow and filled with toxic enzymes that folks with sensitive skin are allergic to. For many people serious rashes develop. It's actually called "urtication" and many social insect colonies develop this strategy to keep birds and other predators at bay. Think "stinging nettles".

FEATURE CREATURE

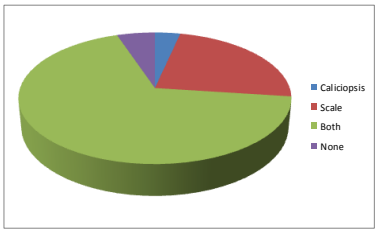
By: Jen Weimer

White Pine Bast Scale
Matsucoccus macrocicatrices

The pine bast scale *Matsucoccus macrocicatrices* feeds exclusively on white pine and until recently had been considered an insignificant forest pest. Recent reports out of the southeast and surveys in NH suggest this pest may be a contributing factor to white pine dieback and mortality. Historically this scale had been reported in northeastern North America from the Canadian Atlantic Maritimes to Massachusetts but it can now be found as far west as Michigan and as far south as Georgia. It was first reported in Georgia in 2013 in association with *Caliciopsis pinea* cankers and prompted surveys to determine if it was also present in NH's declining white pine stands.

In 2015 and 2016 white pine stands at 21 sites in NH were surveyed for *C. pinea* cankers. White pine saplings were present in 17 of those sites. In early May 2017, these 17 sites with saplings were resurveyed to determine if pine bast scale was also present. The 20 closest white pine saplings to plot center were randomly selected and examined in the field. Of the 344 saplings surveyed; 3% had *C. pinea* only, 5% had neither *C. pinea* nor scale, 24% had scale only, and 68% had both *C. pinea* and scale present. This survey suggests that there is likely a relationship between pine bast scale and *Caliciopsis pinea*.

Incidence of Pine Bast Scale & *Caliciopsis* Pine Canker on White Pine



Pine bast scale is often found occurring mutualistically with the epiphytic fungus *Septobasdium pinicola*. In the north *M. macrocicatrices* has a 2 year life cycle (1 year in the south). Adult females are 3.6-4.0 mm, wingless, and emerge from the overwintering cyst stage in late spring to lay eggs in bark crevices, cankers, and under lichens. Eggs hatch into 0.6-1.5 mm yellow-brown crawlers which nestle into *S. pinicola* fungal mats or lichen to feed for 2 years (in the north) in a legless intermediate stage before maturing. Adult males are winged but do not fly and emerge from waxy cocoons made by the prepupa.

***M. macrocicatrices* is easiest to see with the naked eye in the spring just before they emerge from the cyst stage**

Office Notes

The NH Forest Health Program office and lab is located at the Caroline A. Fox Research and Demonstration Forest in Hillsboro. Our small staff monitors the condition of New Hampshire's 4.8 million acres of forest. You can help by contacting us if you observe any forest damage. Photos can be uploaded at NHBugs.org or you can contact us for a site visit. You can also follow us on social media to keep up to date on forest health issues. So far this year we reached 371 page likes on Facebook and 536 followers on Twitter! We now also have an Instagram account so be sure to check us out there as well. In addition we email quarterly updates in March, June, and September. If you're not already on the mailing list you can sign up on our website or Facebook page.

NEW: Department Name Change

As of July 1, 2017 and the adoption of the New Hampshire's state budget for Fiscal Year 2018-2019, the Department of Resources and Economic Development has undergone a reorganization. The reorganization is the result of Governor Sununu's efforts to refocus the divisions of Economic Development and Travel & Tourism Development into the Department of Business and Economic Affairs. The Department of Cultural Resources has been combined with the Division of Parks and Recreation and the Division of Forest & Lands to form the Department of Natural and Cultural Resources.

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